



NAVMSMO VV&A TWG-18

14 September 2004

TMAP // CASSANDRA

This brief is UNCLASSIFIED.



Agenda

- **Issues Driving TMAP**
- **TMAP**
 - **Threat Modeling & Analysis**
 - **ONI's Vision**
- **Cassandra**
 - **Undersea Engagement Tool**
 - **Screen Captures**
- **Caveats**
- **Summary**



Issues Driving TMAP

- **Large number of threat weapon systems**
 - **Limited resources: analysts, time, funding**
 - **Can't efficiently analyze with current methods**
- **Current database inadequacies**
- **Growing M&S demand**
 - **Multitude of customers, each with specific needs**
- **"Validated" threat models**
 - **Validated threat data**



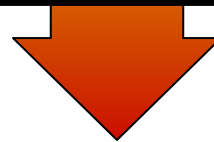
TMAP Vision

1. **ENHANCE ANALYTICAL DISCOVERY PROCESS, and**
2. **MODERNIZE INTEL PRODUCTS & DATABASES**

**(From words, parametric data, and
engineering equations)**

Threat DB

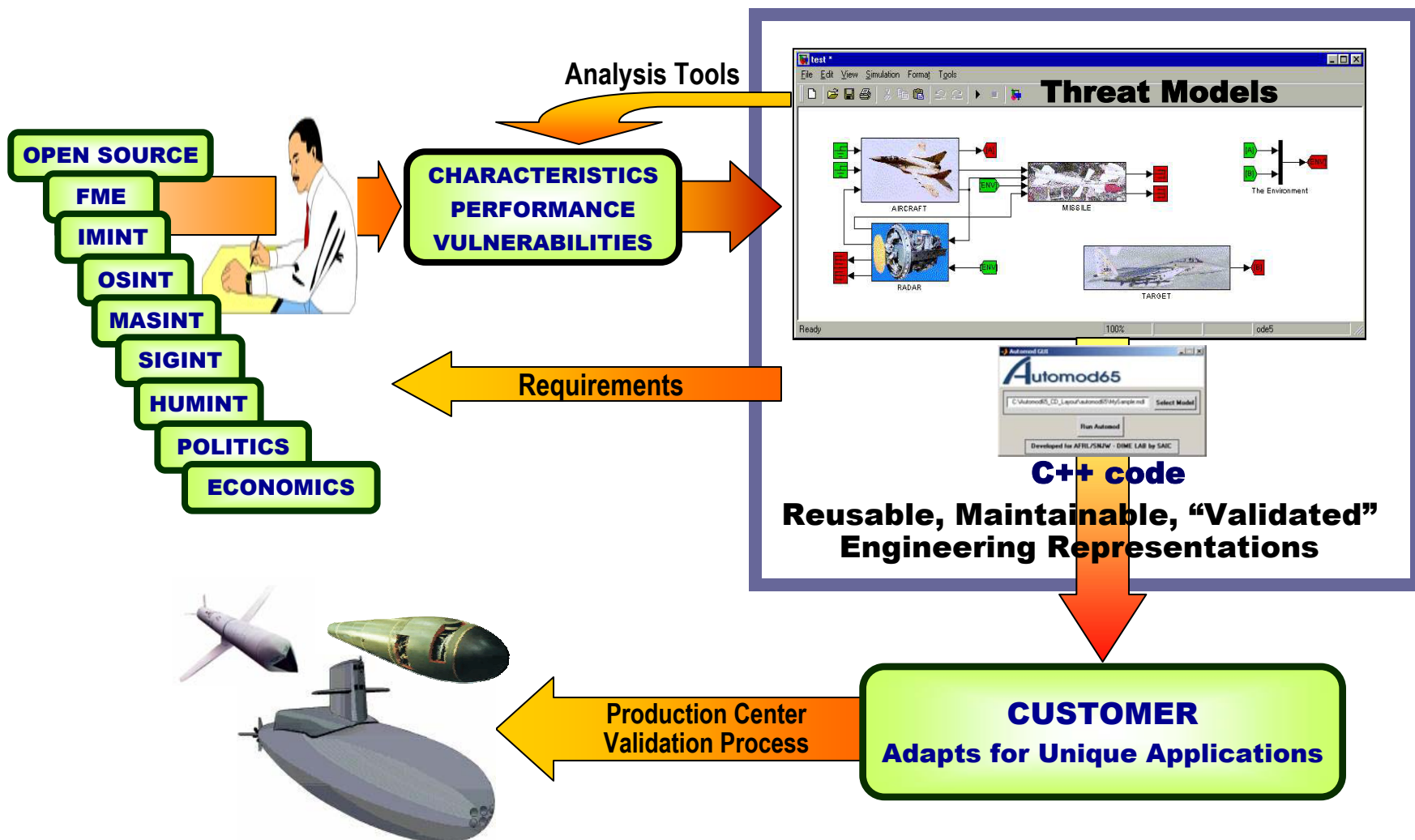
**CHARACTERISTICS
PERFORMANCE
VULNERABILITIES**



**TO INCLUDE REUSABLE, DIGITAL ENGINEERING
THREAT REPRESENTATIONS**



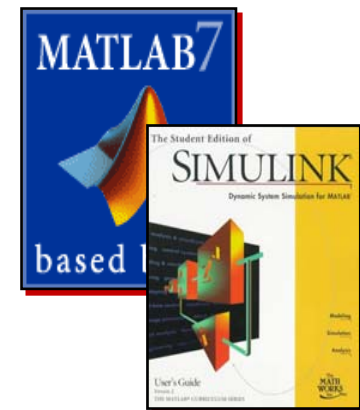
Production with TMAP





The COTS Solution

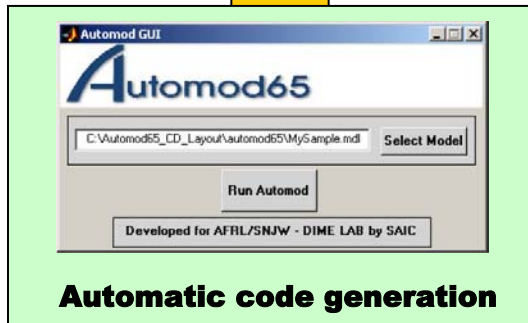
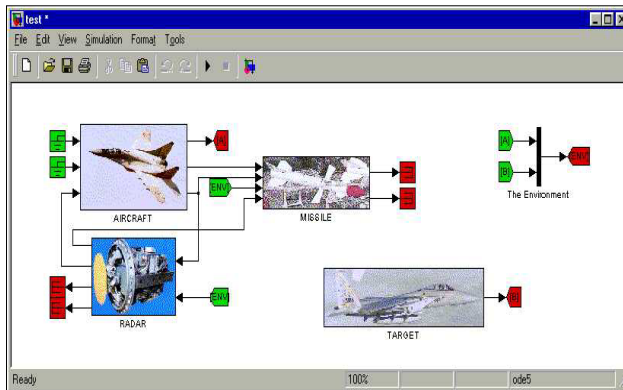
- **Describe threat models using MATLAB / SIMULINK®**
 - **Widespread academic & industry use**
 - **Intuitive for system design & analysis**
 - **Easily maintained & reused by Intel analysts**
 - **Used by IPCs to support FME**
 - **Near-automated documentation generation capability**
 - **Database connectivity**
- **Allows tools and analytical techniques to be shared across the community in a common manner**





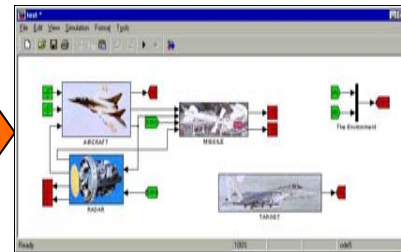
Supporting M&S Customers

Intelligence Community



**C++ threat
objects**

Customer Community



**Customer uses native
SIMULINK objects as
threat documentation**

**Customer re-codes
SIMULINK objects to
meet simulation needs**

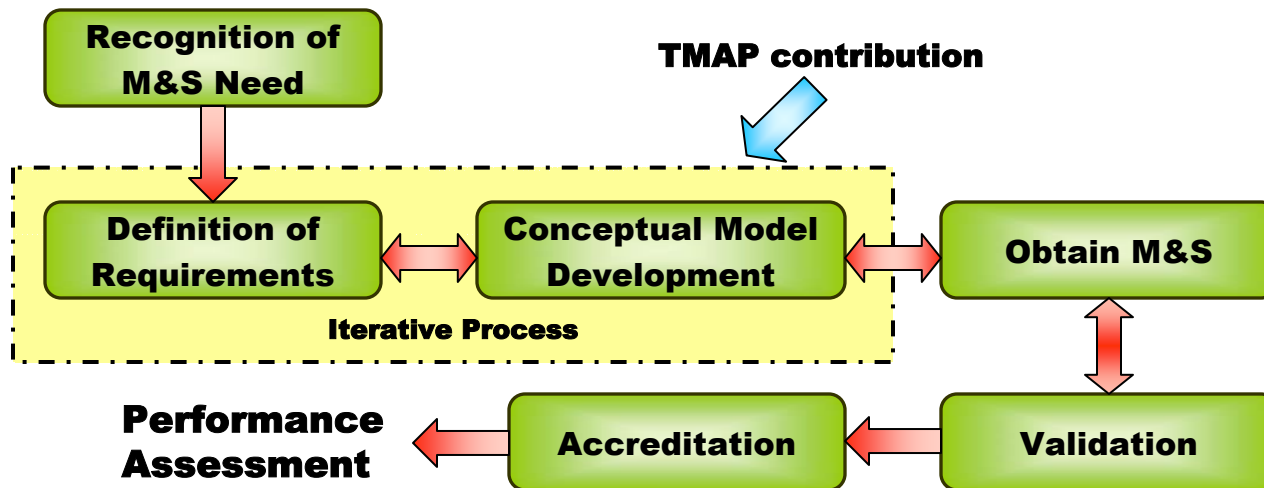
**C++ threat
objects**

**Customer imbeds
C++ objects into
simulation**



TMAP & Validation

M&S Process



- **Validation process simplified**
 - **TMAP offers more-portable code that accurately represents intelligence threat assessment**
 - **TMAP does NOT avert the need for a robust validation process**



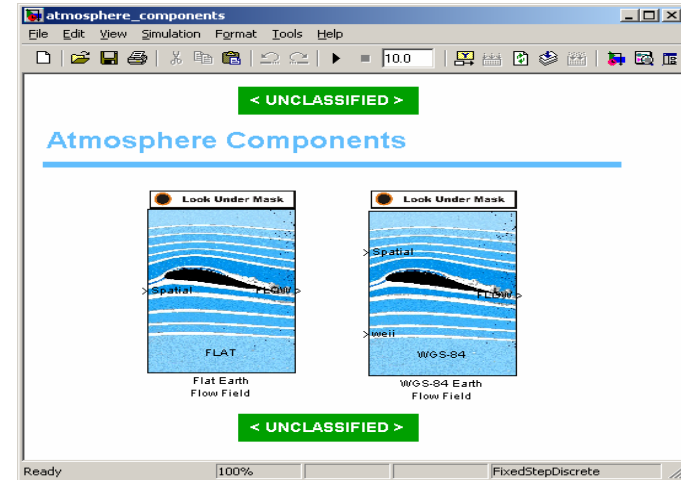
Implementing TMAP at ONI

- **Develop common threat modeling architecture**
 - **“Streamline the creation, testing, and export of threat weapon system models”**
 - **Conform models to a set of uniform standards**
 - **Built from components**
 - **Modular environmental tools**
 - **Fixed-step discrete numerical methods**
 - **Establish a library of systems & subcomponents**
 - **“Building Blocks” construction for rapid modification**

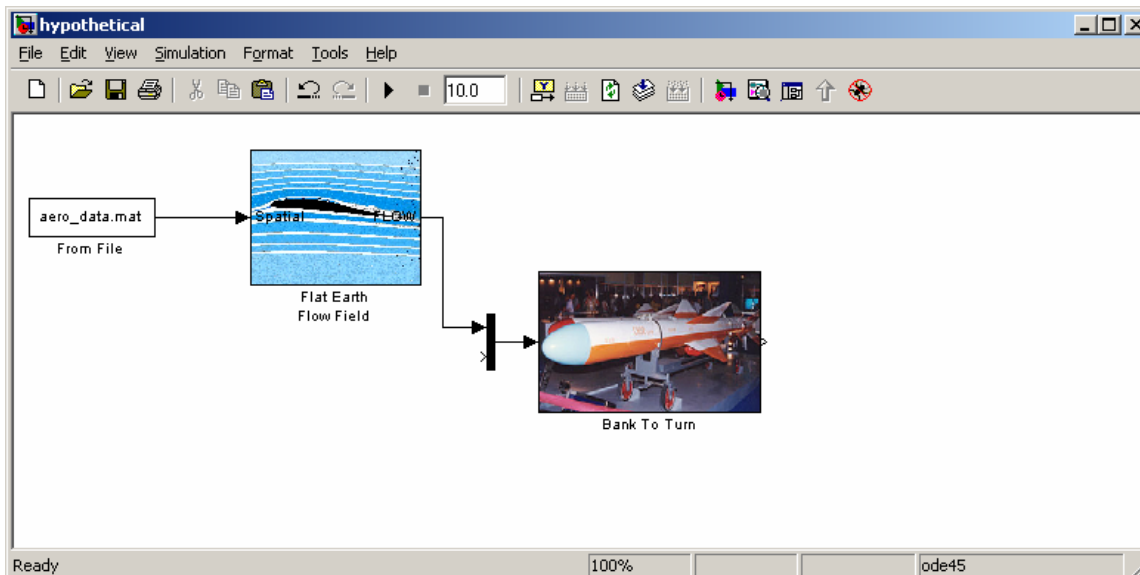
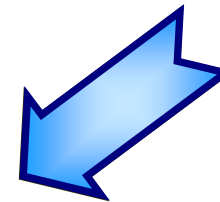


Demonstrating the “LEGO®” Concept to Building Threat Models

- **Components reside in a common library**
- **Physical parameters derived from Intel**
- **Input into generic model**
- **Choose appropriate subcomponents**



Aerodynamic Data

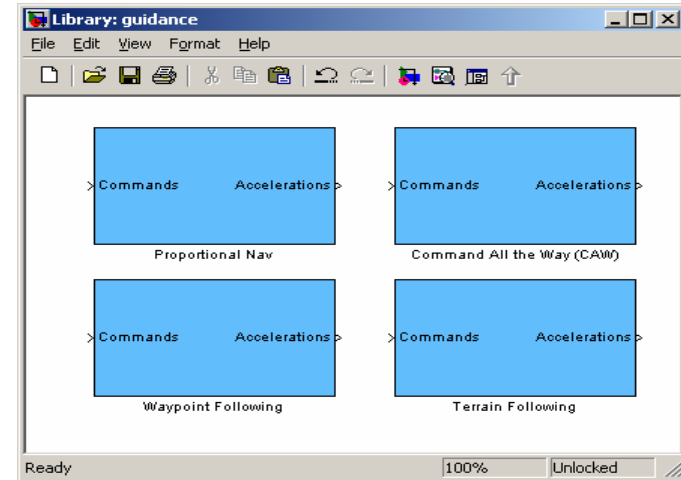


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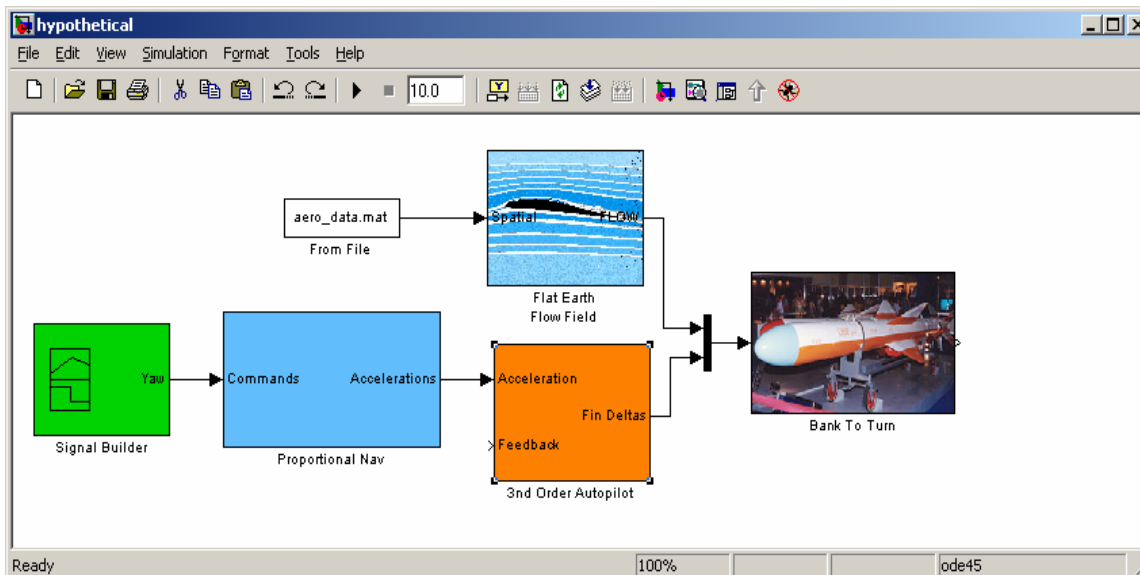
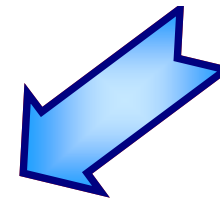


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Guidance

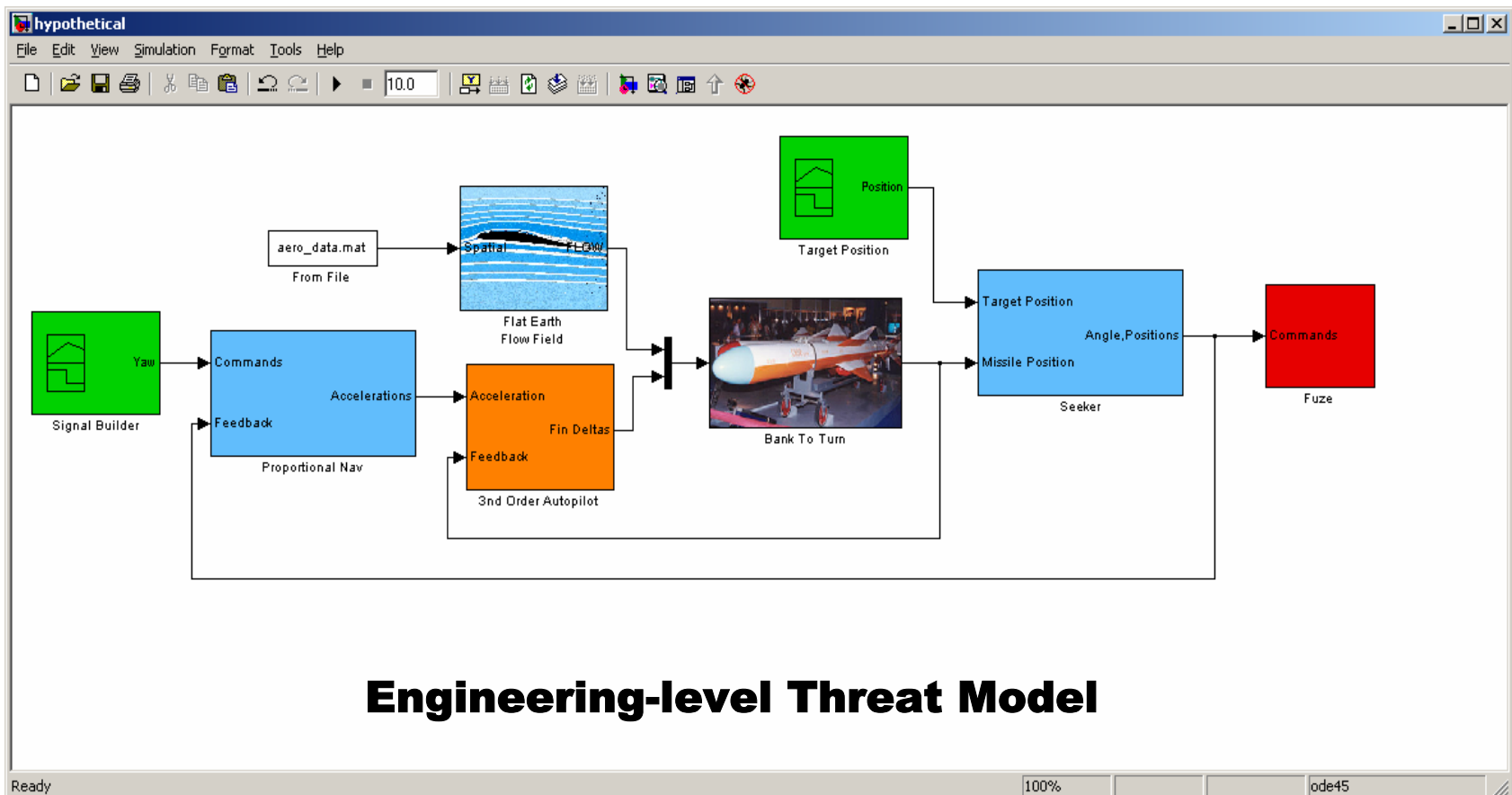


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Building Threat Models

- **Technical details & operational capabilities captured in a form that can be applied to intelligence and external analysis requirements**





Threat “Building Blocks”

- **Why?**

- **Visual and intuitive**
 - Intel analysts versus Software engineers
- **Common subcomponents can be shared & reused**
- **Subcomponents reside in an accessible library**
 - SIPRNET and / or CD releases
 - IPCs maintain oversight over library repository
- **Facilities sharing information in a timely manner**

- **Is it Realistic?**

- **MSIC & NASIC have demonstrated success**
 - Models must conform to a common architecture
- **Customer input / feedback is appreciated...**



ONI's TMAP Status

- **Developing initial capabilities & processes**
 - **Expected to start coming on-line in 2005**
- **Initial model development based on internal priorities**

- **Undersea**

- **Torpedoes & CM**
- **SLBM**
- **Sonar**



Focused initial efforts here due to unique area of responsibility



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- **Maritime**

- **Radar (EW, Search, Track, & Acquisition)**
- **ASCM**
- **SAM**
- **Gun**



Leveraging IC efforts in areas of overlapping responsibility



Cassandra

- **Undersea Engagement Simulation Tool**
 - **A generic object oriented undersea warfare simulation environment, written in C++. It provides a 'whole system' integrated approach, enabling modeling and simulation of diverse applications using one tool.**
- **Software requirements**
 - **JMASS for simulation engine**
 - **SIMDIS for visualization**





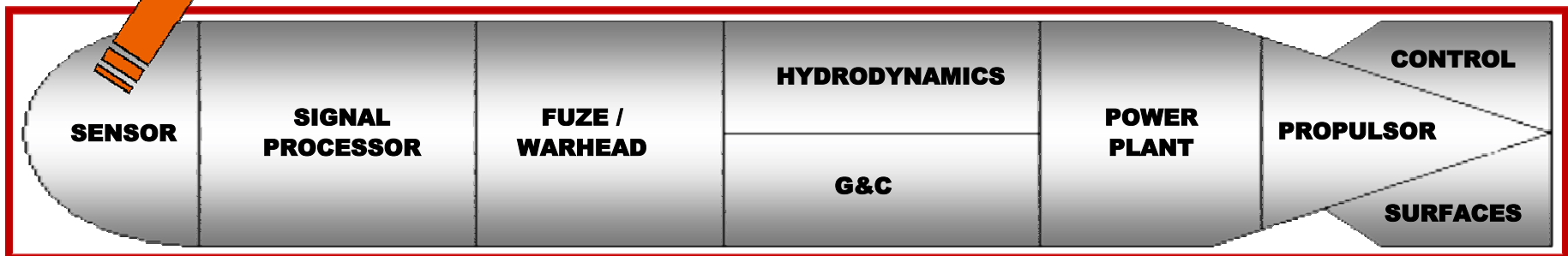
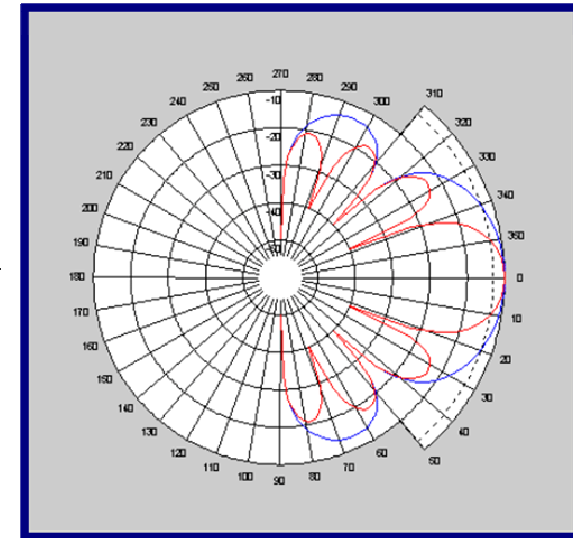
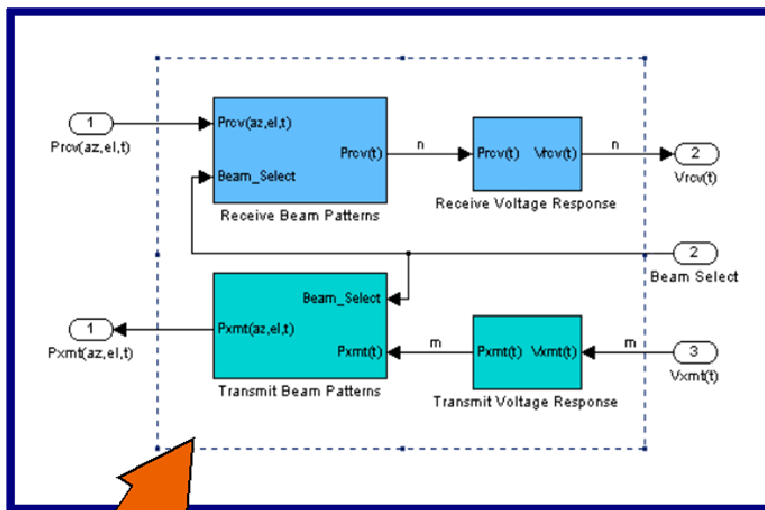
Why Cassandra?

- **Meets ONI needs**
 - **In-house S&TI analysis of torpedoes & torpedo CM**
 - **May have utility for others**
- **Platform flexible (Windows, LINUX, UNIX)**
- **Composable models for rapid modification as threat data changes (TMAP)**
 - **SIMULINK® threat models**
 - **Exported C++ (same as WAF source code)**
- **Variable fidelity**
- **Open architecture**
- **Leverage existing Navy models (e.g. WAF, CASS/GRAB)**
- **DIA funding drove some decisions**



Modular System Development

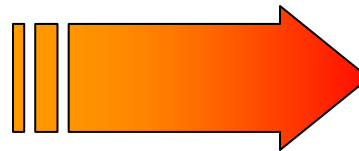
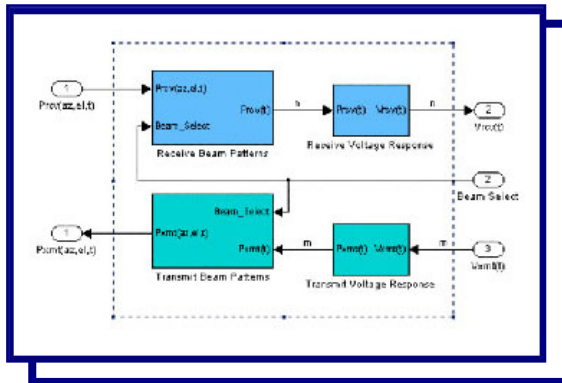
Modular subcomponents may be analyzed separately or together to characterize system parameters



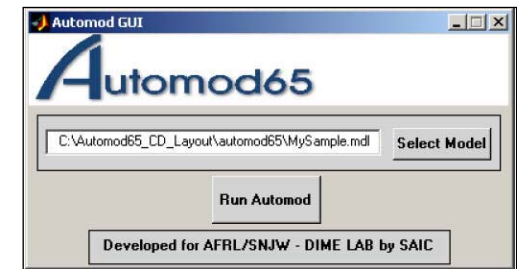


Modular System Development

TMAP System Components



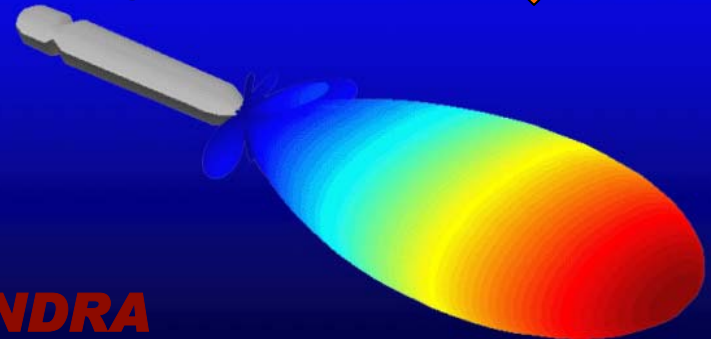
RTW & AUTOMOD



Automatic code generation

- **Modules are integrated to produce a “generic entity” for simulation**
 - **Components can be re-composed in Cassandra to form new entities**

Generic Entity



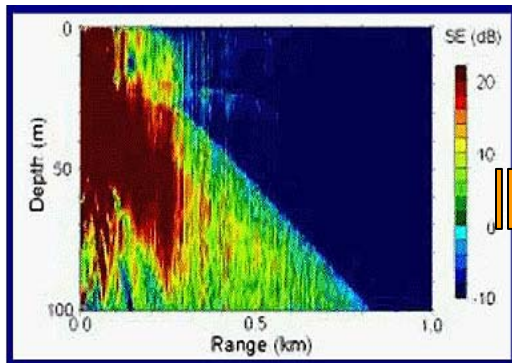
CASSANDRA



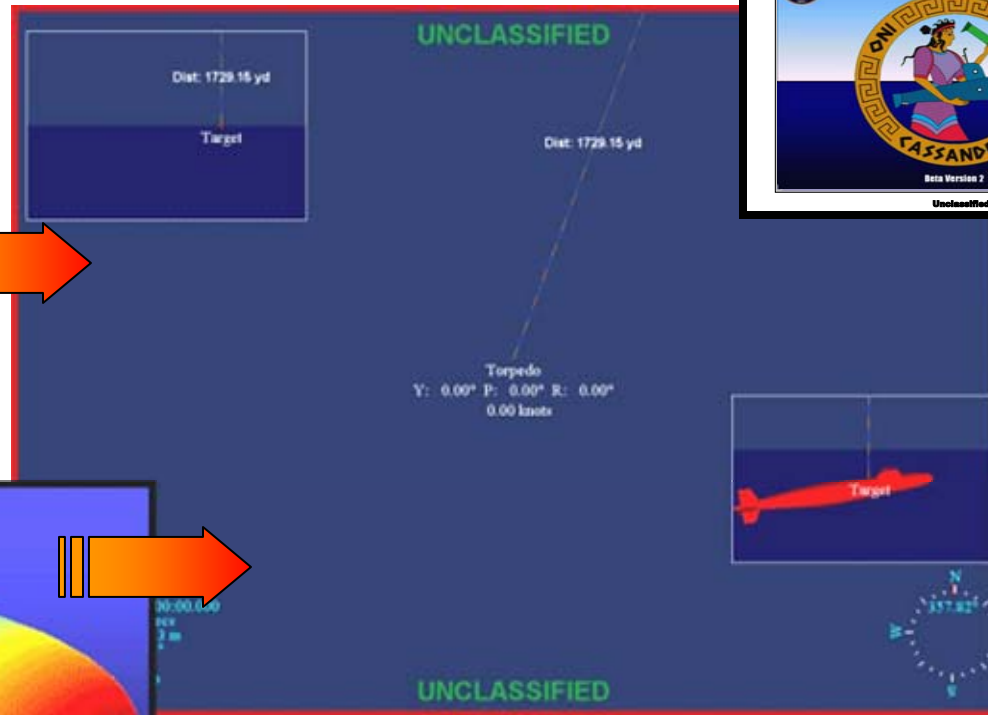
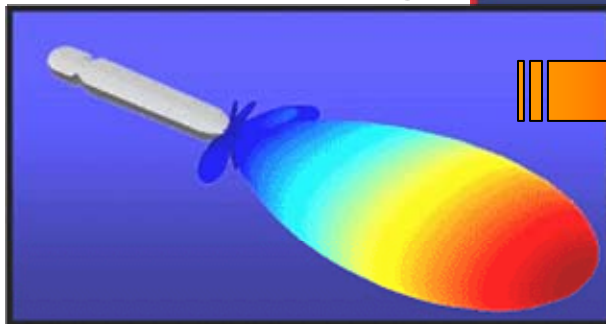
Composable M&S Capability

- **System representations placed in various environments and run against various targets and geometries**
 - **Easy configuration via scenario GUI**

Environment



Generic Entity





Cassandra: Applications

- **Scientific & Technical Intelligence Analysis**
 - **Detailed technical characterization of threat systems**
 - **Variable fidelity M&S products**
- **System Performance Studies**
 - **Design tradeoff studies**
- **Threat Tactics Analysis**
 - **Characterize effect of system design on utilization**
- **Engagement Studies**
 - **Theater Specific Engagement**
- **Monte Carlo Analysis**
 - **Statistically significant number of simulated events**
 - **Campaign level M&S support**



Cassandra: Status

- **Software is currently in beta testing**
 - **Distributed to a limited group for evaluation**
 - **Expected to come online in the Spring 2005**
- **Current development based predominately on internal requirements (i.e., intelligence analysis)**
 - **Still developing policy / procedures for software distribution and joint development**
 - **Customer input is welcomed**
- ***Initial population of threat models based on FME***
 - **Limited V&V based on exploited hardware**



Caveats

- **COTS is NOT a panacea for every M&S problem**
- **TMAP only provides a core set of threat models at a given level of fidelity**
 - **Development of capabilities beyond this “core” will require discussion and additional resources**
 - **Extent of “core capabilities” NOT yet defined**
- **ONI production schedule NOT yet established**
- **Much work ahead to achieve the TMAP vision**



Summary

- **Modernize ST&I analysis**
 - **Provide the most accurate threat assessment possible**
 - **Enhance the dissemination of information**
- **TMAP is intended to supplement current IC products**
 - **Provide a core set of threat models at various level of fidelity**
- **Initial M&S efforts to come online Spring 2005**
 - **Developed to address internal needs**
- **Customer input is appreciated**
 - **Feedback, requirements, and funding**